

IN THE CLAIMS

1. (Previously Presented) A method for removing a halogen-containing residue from a substrate, the method comprising the steps of:

providing an etched substrate having a halogen-containing residue, comprising at least one of chlorine or bromine, formed during etching of a polysilicon layer of the substrate;

heating the etched substrate to a temperature of at least 50°C in a non-plasma gas mixture comprising oxygen and nitrogen; and

exposing the heated substrate to a plasma that removes the halogen-containing residue.

2. (Original) The method of claim 1, wherein the exposing step further comprises maintaining the temperature of the substrate between from about 50°C to about 450°C.

3. (Original) The method of claim 1, further comprising forming the plasma by energizing a gas mixture in a remote plasma reactor.

4. (Original) The method of claim 1, wherein the halogen-containing residue comprises bromine.

5. (Original) The method of claim 4, wherein the plasma comprises an oxygen-containing gas.

6. (Original) The method of claim 5, wherein the oxygen-containing gas comprises an oxidizing agent selected from the group consisting of oxygen, water vapor and ozone, and an additive selected from the group consisting of nitrogen, argon and helium.

7. (Original) The method of claim 1, wherein the halogen-containing residue comprises chlorine.

8. (Original) The method of claim 7, wherein the plasma comprises a hydrogen-containing gas.

9. (Previously Presented) The method of claim 8, wherein the plasma comprises hydrogen, water vapor, oxygen, and nitrogen.

10. (Cancelled)

11. (Previously Presented) The method of claim 1, wherein the exposing step further comprises maintaining the temperature of the substrate at about 250°C.

12. (Previously Presented) The method of claim 6, wherein the oxygen-containing gas and the additive respectively comprise oxygen and nitrogen provided in a flow ratio of oxygen to nitrogen of about 10:1.

13. (Original) The method of claim 9, wherein the flow ratio of oxygen to hydrogen is from about 150:1 to about 5:1, and the flow ratio of hydrogen to water vapor is from about 2:1 to about 1:1.

14. (Previously Presented) The method of claim 9, wherein the hydrogen and nitrogen are at least partially provided via a forming gas having a flow rate of from about 500 to 5000 sccm.

15. (Original) The method of claim 9, wherein the flow rate of water vapor is from about 100 to 3000 sccm.

16. (Original) The method of claim 9, wherein the flow ratio of oxygen to water vapor of from about 10:1 to 3:1.

17. (Previously Presented) The method of claim 1, wherein the plasma comprises an oxygen-containing gas at a pressure of from about 0.5 to about 2 Torr.

18. (Original) The method of claim 6, wherein the duration of the exposing step is from about 15 to about 90 seconds.

19. (Previously Presented) The method of claim 8, further comprising maintaining the hydrogen-containing gas at a pressure of from about 0.5 to about 2 Torr.

20. (Original) The method of claim 9, wherein the duration of the exposing step is from about 15 to about 60 seconds.

21. (Previously Presented) A method for removing a halogen-containing residue from a substrate, the residue formed during etching of the substrate, the method comprising the steps of:

providing a substrate having a polysilicon layer on the substrate;

etching the polysilicon layer and forming a halogen-containing residue comprising at least one of chlorine or bromine on the substrate;

heating the substrate to a temperature of at least 50°C in a non-plasma gas mixture comprising oxygen and nitrogen; and

exposing the heated substrate to a plasma that removes the halogen-containing residue.

22. (Previously Presented) The method of claim 21, wherein the exposing step comprises maintaining the temperature of the substrate between 50°C and 400°C.

23. (Original) The method of claim 21, further comprising forming the plasma by energizing a gas mixture in a remote plasma reactor.

24. (Cancelled)

25. (Original) The method of claim 21, wherein the etching step comprises etching the substrate with a gas mixture comprising a halogen gas and a reducing gas.

26. (Original) The method of claim 21, wherein the halogen-containing residue comprises bromine.

27. (Original) The method of claim 26, wherein the plasma comprises an oxygen-containing gas.

28. (Previously Presented) The method of claim 27, wherein the oxygen-containing gas comprises an oxidizing agent selected from the group consisting of oxygen, water vapor and ozone and an additive selected from the group consisting of nitrogen, argon and helium.

29. (Original) The method of claim 21, wherein the halogen-containing residue comprises chlorine.

30. (Original) The method of claim 29, wherein the plasma comprises a hydrogen-containing gas.

31. (Previously Presented) The method of claim 30, wherein the plasma comprises hydrogen, water vapor, oxygen and nitrogen.

32-34. (Cancelled)

35. (Previously Presented) The method of claim 1, wherein the substrate is heated in a gas mixture of oxygen and nitrogen for a duration of about 10 to about 20 seconds.

36. (Previously Presented) The method of claim 1, wherein the gas mixture of oxygen and nitrogen are provided at flow rates of about 5000 sccm of oxygen and about 500 sccm of nitrogen.

37. (Previously Presented) The method of claim 1, wherein the gas mixture of oxygen and nitrogen are provided at an O₂:N₂ flow ratio of about 10:1.

38. (Previously Presented) The method of claim 1, wherein the substrate is heated at a pressure of greater than about 1 Torr.

39. (Previously Presented) The method of claim 21, wherein the substrate is heated in a gas mixture of oxygen and nitrogen for a duration of about 10 to about 20 seconds.

40. (Previously Presented) The method of claim 21, wherein the gas mixture of oxygen and nitrogen are provided at flow rates of about 5000 sccm of oxygen and about 500 sccm of nitrogen.

41. (Previously Presented) The method of claim 21, wherein the gas mixture of oxygen and nitrogen are provided at an O₂:N₂ flow ratio of about 10:1.

42. (Previously Presented) The method of claim 21, wherein the substrate is heated at a pressure of greater than about 1 Torr.

43. (Previously Presented) A method for removing a halogen-containing residue from a substrate, the method comprising the steps of:

providing an etched substrate having a halogen-containing residue, comprising at least one of chlorine or bromine, formed during etching of a polysilicon layer of the substrate;

heating the etched substrate to a temperature of at least 50°C; and

exposing the heated substrate to a plasma that removes the halogen-containing residue, wherein the plasma comprises hydrogen, water vapor, oxygen, and nitrogen.

44. (Previously Presented) The method of claim 43, wherein the flow ratio of oxygen to hydrogen is from about 150:1 to about 5:1, and the flow ratio of hydrogen to water vapor is from about 2:1 to about 1:1.

45. (Previously Presented) The method of claim 43, wherein the hydrogen and nitrogen are at least partially provided via a forming gas having a flow rate of from about 500 to 5000 sccm.

46. (Previously Presented) The method of claim 43, wherein the flow rate of water vapor is from about 100 to 3000 sccm.

47. (Previously Presented) The method of claim 43, wherein the flow ratio of oxygen to water vapor of from about 10:1 to 3:1.

48. (Previously Presented) The method of claim 43, further comprising maintaining a chamber pressure of from about 0.5 to about 2 Torr.

49. (Previously Presented) The method of claim 43, wherein the duration of the exposing step is from about 15 to about 60 seconds.

50. (Previously Presented) A method for removing a halogen-containing residue from a substrate, the residue formed during etching of the substrate, the method comprising the steps of:

providing a substrate having a polysilicon layer on the substrate;

etching the polysilicon layer and forming a halogen-containing residue comprising at least one of chlorine or bromine on the substrate;

heating the substrate to a temperature of at least 50°C; and

exposing the heated substrate to a plasma that removes the halogen-containing residue, wherein the plasma comprises hydrogen, water vapor, oxygen and nitrogen.